The right ascensions of the stars in the *American Ephemeris* were adopted for these observations.

There are undoubtedly relatively large systematic errors in the observations of the transits of the limbs of the Moon. The results of every observer exhibit these errors, and no two observers are likely to have the same errors. In general the transits of the preceding limb give larger plus corrections to the tabulated right ascensions. The accidental errors are larger also than those made in observing the transit of a star, in my own case from two to four times as large.

Adopting the mean of the corrections recently observed here, $+ 1^s.15$, the coming eclipse of the Sun next September should occur half a minute earlier than the time as computed from the tabulated right ascensions of the Moon. The *American Ephemeris* includes provisional corrections to the tabular positions, which partially account for this difference.

Of the three methods used in determining corrections to the position, as computed from the gravitational theory, occultations appear to give the smallest corrections, eclipses give the largest, and meridian circle transits give intermediate values.

March 16, 1922. R. H. TUCKER.

ON THE SECULAR CHANGE IN THE PROPER-MOTION OF BARNARD'S STAR

It was suggested by Bessel[1] that stars of rapid apparent motion might show an appreciable secular change in the total proper-motion. Schlesinger[2] derived a formula which connects the secular change of proper-motion with the product of parallax and radial velocity. Adopting the radial velocity at 100 km. per sec. and the parallax at $0''.5$, he calculated a progressive increase in the motion of $0''.0005$ per year. With the object in view of evaluating the variation with the greatest possible accuracy, all

[1] *A. N.*, **22**, 145, 1844.
[2] *A. J.*, **30**, 137, 1917.
[3] *M. N.*, **77**, 42, 1916.

of the data at present available for this star have been collected and are given in the accompanying table.

OBSERVER	EPOCH	INSTRUMENT	REFERENCE
Lamont	1842.56	Mer cir.	MüI 15040
Argelander	54.5	Equat.	BD + 4°3561
Barnard	94.648	Photo.	*A. J.* **29**, 181, 1916
Gonnessiat	97.589	"	*Bull. Astr.* **33**, 333
Toulouse Astr.	98.56	"	*M. N.* **77**, 42, 1916
Wolf *et al.*	1898.565	"	*A. N.* **214**, 215, 1921
"	1904.376	"	"
"	04.382	"	"
"	04.434	"	"
"	08.496	"	"
Gonnessiat	10.452	"	*Bull. Astr.* **33**, 333,1916
Wolf *et al.*	14.385	"	*A. N.* **214**, 215, 1921
"	14.406	"	*A. N.* **214**, 215, 1921
Barnard	16.423	Micr.	*A. J.* **29**, 181, 1916
Greenwich	16.59	Mer. cir.	*M. N.* **77**, 42, 1916
Millosevich	16.700	Micr.	*Oss. C. Rom.* **3**, 7, 56, 1919
Barnard	16.000	Micr.	*A. J.* **30**, 79, 1917
Gonnessiat	16.764	Photo.	*Bull. Astr.* **33**, 333, 1916
Kostinsky	17.473	"	*A. N.* **208**, 35, 1919
Graff	19.52	Micr.	*A. N.* **209**, 239, 1919

Crommelin has carefully re-reduced Lamont's observations of Mü I 15040 and has proved its identity with Barnard's star; his position was accordingly adopted. The observations were all reduced to the equinox 1900.0 and corrections for annual parallax were applied, as it was assumed that none of the published observations had been corrected for this.

The correction for annual parallax can amount to $\mp 0^s.037$ in R. A. and $\mp 0''.26$ in Dec. respectively. As there are only two meridian observations available, no systematic corrections have been applied to those, and all observations are used with equal weight. A least squares solution yields the following result for the equinox and epoch 1900.000. The errors indicated are mean errors.

$$\begin{aligned} \text{R. A. } 17^h52^m56^s.767 &- 0^s.0467\, t \\ &\mp .0036 \quad \mp .00020 \\ \text{Dec. } 4°25' \; 8''.56 &+ 10''.250\, t - 0''.00070\, t^2 \\ &\mp .125 \quad \mp .0130 \quad \mp .00032 \end{aligned}$$

For the right ascension no attempt was made to derive a quadratic term. As previous to 1894 no observations except Lamont's are available, the secular term depends almost entirely on this one observation.

Since the secular change of the proper-motion has been de-

veloped in terms of the total proper-motion, radial velocity and parallax, it is possible, from a knowledge of three of these quantities, to derive the fourth. For the radial velocity only two definite determinations exist, *viz.*, — 94 km. (Mount Wilson) and — 128 km. (Lick), which gives for the weighted mean — 117 km./sec. with an error probably not exceeding 20 km. With this value and the adopted parallax value of 0″.55 $\mp$ ″.01 we compute the secular change in proper-motion at 0″.00068 $\mp$ ″.00012.

1922 March 3.

KNUT LUNDMARK,
WILLEM J. LUYTEN.

ON THE COLOR OF THE STARS

The data collected from the *Henry Draper Catalogue of Stellar Spectra* by Dr. Harlow Shapley and Miss Cannon and published in *H. C.* **226** afford excellent material for a study of the color of the stars.

By means of the values of the color-index for the different spectral classes given in *H. A.* **80**, 151, the mean color-index was derived for each of the 8 groups of stars of different magnitude in *H. C.* **226**, Table I. For the division of the brighter stars into groups with half-magnitude intervals, *H. A.* **50** was used. As the system of spectral classification in *H. A.* **50** is not the same as in the *Henry Draper Catalogue* (e. g., in *H. A.* **50** there are 1,549 A0, 325 A2 and A3, 1,302 K0 stars brighter than $6^m.25$, in the *H. D.* 736, 728 and 1,310 respectively), a systematic correction of $+ 0^m.025$ was applied to the *H. A.* **50** values. This correction was deduced from the fact that the mean color-index of all stars brighter than $6^m.25$ visually was $0^m.423$ in *H. A.* **50** and $0^m.448$ in *H. C.* **226**.

Throughout the investigation stars of classes P, O, Md, N and R have been omitted, since they are not included in the tables in *H. C.* **226**, which omission may tend to decrease slightly the slope of the color-index-magnitude curve.

The values for the mean color-index for each interval of half a magnitude are tabulated below. From left to right the differ-